REMARKS

Applicants' respectfully request reconsideration of pending claims 1 – 13 and 16 – 24 in light of the present amendments and following remarks. Additionally, new claims 64 and 65 represent previously pending dependent claims 6 and 21 which had been noted would be allowable if rewritten in independent form. New claims 64 and 65 are these previously pending dependent claims 6 and 21 written in independent form containing all the limitations of the independent claims, namely, claims 1 and 16, respectively, from which they depend.

With respect to independent claims 1 and 16 from which all other pending claims depend, by the present amendment, Applicants have amended the claims to clarify the complementary beam-forming aspect of the claimed inventions. Applicants believe that a few words on complementary beam-forming may be helpful to the prosecution of this application. In an ESMA system, such as what is used in Wi-Fi (802.11), communication environment, an antenna assembly is commonly able to communicate with a plurality of authorized client computing devices located within the effective coverage area of that antenna assembly. When the antenna assembly is communicating with a first client device using 802.11, it is helpful if other client devices within the coverage area are aware of the first ongoing communication so that they will not try to communicate with the antenna assembly on the same channel. Such attempts to communicate with the antenna assembly on the same channel being used by the first client device can result in the corruption of data and unwanted interference with the ongoing communication between the antenna assembly and the first client device. In order to make the other

client devices aware of the ongoing communication, those other client devices should be able to sense signals indicative of the ongoing communication (even if those signals are at such a low level that they cannot be decoded). The present inventions address the desirability of providing signals to these other client devices in order to avoid interference with the ongoing communication between the antenna assembly and the first client device.

The desirability of providing a signal indicative of the ongoing communication to the other client devices is particularly desirable in areas of nulls. With reference to Fig. 15 of Applicants' present application, the effect of complementary beam-forming is indicated by the comparison of original beam 1502 with beam 1504 which has been subject to complementary beam-forming. As indicated in Fig. 15, the signal level of the nulls in signal 1504 have been significantly elevated relative to the nulls of signal 1502.

Paragraphs [0114] - [0117] of the present application describe complementary beam forming as "a technique to reduce the effect of communication beam nulls and increase side lobe levels without a severe power penalty to the main beam." Complementary beam-forming, as described in the present application, is utilized as a technique to ensure a minimum transmit power in all directions, by reducing the "hidden beam" effect of nulls in certain directions that may accompany a directional communication beam, such as in Adachi. That is, fanning directional transmit communication beams, as in Adachi, has the side effect of hiding the transmitted energy from some client devices, negatively impacting their carrier sense mechanisms in a network. Since the present invention is intended to be an open network, the hiding of the

beam from certain areas or client devices is directly contrary to the purpose of the invention, which is both inclusive as to the range of generation of the beam, and restrictive as to deliberately directing transmission nulls where there is interference and the like.

For example of the difference, a client device can measure the energy transmitted from access points and from other client devices. If a client device cannot detect the presence of other transmissions, due to use of directional communication beams, it may interpret the medium as being idle and attempt to access the medium, when, in fact, the medium is busy. These competing access attempts have a burdening effect on the performance of the network. Complementary beam- forming, as claimed and defined by the present application, ensures that multiple transmit beams in arbitrary directions are complemented by another beam in all other directions. The complementary beam does not interfere with the intended beams and increases the probability that other users in the network can detect whether the medium is idle or available for their use, thus contributing to the efficient usage of the network.

With this distinction in mind, Applicants have amended both originally pending independent claims 1 and 16 by changing the phrase "by complementary beam-forming to increase side lobe levels" to "by complementary beam-forming to increase radiation levels of the nulls outside of the directed beam".

Applicants respectfully submit that these amendments to independent claims 1 and 16, and all claims dependent thereon clarifies the differences between Applicants' claimed invention and the cited combination of Periyalwar in view of Adachi et al. and

in further view of Corbell et al. Applicant again notes that the Periyalwar reference and the Adachi reference are not conceded to be prior art, and Applicants reserve the right to swear behind these asserted references at a later date, if necessary. Nonetheless, in the interest of advancing the prosecution of the present application, Applicant respectfully submits that the elements and limitations of the claims of the present application can be distinguished from the teachings of the Periyalwar and Adachi references for at least the following reasons.

The earlier Office Action took the position that Adachi teaches complementary beam-forming where it describes how one might narrow the main lobe of a beam to reduce interference. As described in Adachi, this process is not complementary beam-forming in implementation or intent.

Adachi paragraph 167 describes forming a beam using complex weights (applied to the antenna elements to form a desired antenna pattern, such as a beam). Adachi paragraphs 171 and 174 then describe modification of those weights to improve the pointing accuracy toward the target-to-be-illuminated. When the target position is precisely known, Adachi notes that the complex weights can be adjusted to reduce the spread of the antenna pattern around the target and that by narrowing the main beam, ***interference to other communicating devices in the area can be reduced.*** This is the antithesis of Applicants' recited complementary beam-forming which is intended to increase the signal level of the radiation levels outside of the directed beam. It should also be noted, however, that if the main beam is narrowed, side lobe peak levels generally

do increase but nulls in the antenna pattern (between the lobes/side lobes) still remain deep absent other steps taken to specifically address this issue.

As an explanation from a filtering perspective, Adachi's method can be viewed as designing (and revising) a spatial filter using complex filter coefficients. Unless the system main lobe gain is sacrificed to pull the zeros away from the imaginary spatial frequency axis---in other words, unless the response of the system is 'dampened'---the nulls in the antenna pattern (i.e., spatial response) will always be deep.

The intent of complementary beam-forming is not to narrow any of its fixed main-beam shapes. To the contrary, the intent of complementary beam forming is to raise the radiated levels outside the main beam---most specifically in the regions of the nulls (as opposed to just the side lobe peaks). See Figure 15 of Applicants' application, which compares response 1502, without complementary beam-forming, with response 1504, with complementary beam-forming. Note that the effect of complementary beam-forming is to actually increase signal strength, i.e., interference, to the entire system/wireless environment. This interference is necessary in a full duplex CSMA (carrier sense multiple access) system, such as 802.11, to avoid transmission collisions, i.e. so that untargeted clients (outside of the main beam of the AP) can sense that the AP is transmitting and therefore will not attempt to transmit on the same channel and at the same time that a targeted client is trying to receive data from the AP.

Note, also, as Figure 14 and paragraph 119 of Applicants' application illustrate, the implementation of complementary beam-forming involves the real-value attenuating of the input to a single antenna.

Note that this does not involve the specification of multiple complex-value coefficients---as is the case with Adachi's complex weight technique. Such a system using complex weights and their adaptation requires very precise calibration, and is therefore very expensive to practically implement and maintain.

Since the implementation and intent of Adachi's beam-shape process is different from Applicants' claimed invention with respect to both the intent and result, one of ordinary skill would never be lead to Applicants' claimed invention from the teachings of Adachi.

The earlier Office Action also cited Corbell et al's use of increased side lobes to increase area coverage. If one compares Figs. 7 and 9 of Corbell with Fig. 8, one can see that Corbell's adjustments actually increase the gain---and narrow the width---of the main beam. However, in Applicants' invention's implementation of complementary beam-forming, if output power is maintained constant, then increasing the side lobes will actually slightly reduce the reach of the main beam. (In terms of filter theory, one could interpret this as actually dampening the filter response, rather than trying to make it more resonant.) Therefore, the effect taught by Corbell is very different from the one achieved by Applicants' claimed invention.

Therefore, independent claim 1 is neither taught nor suggested by the combined teachings of the cited references. Additionally, independent claim 16 has been amended in the same manner as claim 1 and is therefore allowable for the same reasons. Similarly, each of dependent claims 2 – 13 and 17 – 24 are allowable over the cited references.

CONCLUSION

Applicants respectfully submit that all pending claims as amended, are now in condition for allowance. If the Examiner has any questions or comments which may expedite the prosecution of this application, the Examiner is respectfully requested to contact Applicant's attorney at the telephone number set forth below

Respectfully submitted,
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